PATENT SPECIFICATION 954,623

DRAWINGS ATTACHED.

954,623

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COMPLETE SPECIFICATION.

Improvements relating to Dynamo-Electric Machines.

We, SIEMENS & HALSKE AKTIENGESELLSCHAFT, a German Company, of Berlin and Munich, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to dynamo-electric machines and, in particular, to a fractional horsepower d.c. electric motor.

Direct current electric motors in which a rotor supported on the motor shaft at both ends embraces a core of magnetically conductive or permanently magnetised material rotatably arranged on the rotor shaft, are already known. In these motors, the magnetic excitation is produced in field magnets having pole shoes. However, field magnets having pole shoes located outside the rotor limit the size to which the diameter of a motor of given performance can be reduced.

An object in this invention is to provide a motor of very small diameter, but in which the rotor diameter is made as large as possible relatively to the overall diameter of the motor so that in use a high torque will be produced.

The present invention consists in a dynamo-electric machine including a cylindrical iron housing, a cylindrically-wound armature concentrically mounted for rotation therein and a permanent magnet concentrically positioned within the armature winding and coaxially rotatable relatively thereto, wherein the permanent magnet produces the magnetic exciting flux, wherein portions of this flux circulate through the housing between the poles of the magnet, and wherein the housing is constructed with zones of low magnetic conductivity arranged so that said flux portions bias the permanent magnet to adopt a given stationary position with respect to the housing. Preferably the armature winding is non-ferrous.

In this way a fixed orientation of the permanent magnet in a specific position or in other words an orientation of the central plane of its magnetic flux, passing through the axis of rotation, with respect to the stationary iron casing is produced. These zones of low conductivity run parallel with the axis of the iron casing or at an acute angle thereto. Permanent magnets can also be inserted in these zones.

Since field magnets with pole shoes located outside the rotor or armature are no longer necessary, the diameter of the rotor can now be made larger relatively to the overall diameter of the motor. For a given magnetic induction and given current distribution in the armature, the construction according to the invention is favourable to the development of a higher mechanical torque in the motor. The permanent magnet situated inside the rotor in accordance with the invention serves for magnetic excitation, this magnet although rotatable relatively to the rotor is elastically maintained in a specific stationary position by its own magnetism due to the construction of the iron casing in accordance with the invention which completes the magnetic circuit. The elastic retention of this exciting magnet in its normal position brings with it the further advantage that shock loads acting externally upon the motor spindle, are absorbed to some extent by deflection of the exciting magnet. Due to the construction of the nonferrous rotor, which for the most part comprises in preferred construction simply a copper winding, its mountings, the spindle and the collector, its moment of inertia is kept small.

The preferred manner of performing the

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invention will now be described in more detail, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 illustrates a direct current electric motor in longitudinal section; and

Figure 2 is a section along the line A—A of Figure 1.

The iron housing 1, which simultaneously serves to complete the magnetic circuit, is provided with two diametrically opposite longitudinal slots 2. These slots can be formed in a cylindrical housing but can also be conveniently created by manufacturing the housing from two semi-cylindrical shells shaped to form the slots when mated. In this housing, a spindle 3 and armature 4 are rotatably mounted. The armature windings support comprises, for example, a cylindrical part 5, made of insulating material and initially open at one end, together with a support disc 6, both being firmly attached to the spindle. The winding support could also be formed from a cylindrical casing in conjunction with two end-discs or, alternatively, the winding could be self-supporting and held at the two ends by support discs. On the winding support shown, the winding 7 is placed. Inside it, a permanent magnet 8 is rotatably mounted on the rotor spindle by means of bearings 9. The collector 10 and associated brush-holders 11 are also shown.

The way in which the magnetic bias of the exciting magnet 3 to remain in a given stationary position, and consequently the fixing of the position of the magnetic exciting field, is achieved, will now be described with reference to Figure 2. The path of the magnetic flux is indicated by the broken lines and arrows. In the position shown, the permanent exciting magnet 8 is in the stable position which it always takes up in the rest state. In this position, the magnetic flux, after passing through the working air-gap, passes through an unbroken iron circuit formed by the housing 1. If, however, the exciting magnet 8 is pivoted from this position, then a portion of the magnetic flux is caused to pass through the air-gaps created by the slots 2 as well as through a larger part of the working air-gap than in the normal position. The result of this is the production of a strong restoring torque which returns the exciting magnet 8 to its initial position shown.

The slots 2 which form zones of low magnetic conductivity on the housing can be replaced by material exhibiting poor magnetic conductivity, if total enclosure of the motor is desired.

A further embodiment is that in the slots 2, bar-type permanent magnets are inserted whose field direction corresponds with that of the permanent magnet 8. In this way, the restoring or holding moment acting on the exciting magnet can be increased still further.

WHAT WE CLAIM IS:—

1. A dynamo-electric machine including a cylindrical iron housing, a cylindrically-wound armature concentrically mounted for rotation therein and a permanent magnet concentrically positioned within the armature winding and coaxially rotatable relatively thereto, wherein the permanent magnet produces the magnetic exciting flux, wherein portions of this flux circulate through the housing between the poles of the magnet, and wherein the housing is constructed with zones of low magnetic conductivity arranged so that said flux portions bias the permanent magnet to adopt a given stationary position with respect to the housing.

2. A dynamo-electric machine according to Claim 1, wherein the armature winding is non-ferrous.

3. A dynamo-electric machine according to Claim 1 or Claim 2, wherein the zones of low magnetic conductivity are arranged to extend longitudinally parallel to the housing axis.

4. A dynamo-electric machine according to Claim 1 or Claim 2, wherein the zones of low magnetic conductivity are arranged to make an acute angle with respect to the housing axis.

5. A dynamo-electric machine according to any preceding claim, wherein the zones of low magnetic conductivity formed in the housing are constituted by slots.

6. A dynamo-electric machine according to Claim 5, wherein the slots are formed in diametrically opposed parts of the housing.

7. A dynamo-electric machine according to Claim 6, wherein additional permanent magnets having field directions corresponding to that of the exciting magnet are located diametrically opposed slots in the housing.

8. A dynamo-electric machine according to Claim 6 or Claim 7, wherein the housing has two slots.

9. A dynamo-electric machine according to any of Claims 5 to 7, wherein the housing consists of an assembly of part cylindrical sections shaped to form the slots when assembled to form the housing.

10. A dynamo-electric machine according to Claim 9, wherein the housing consists of two part cylindrical sections.

11. A dynamo-electric machine according to any preceding claim which is a d.c. motor.

12. A dynamo-electric machine according to any preceding claim in which the armature winding is a copper winding.

13. A dynamo-electric machine according to Claim 11 or Claim 12, as appendant to Claim 11, which is a fractional horse-power electric motor.

14. An electric motor constructed and arranged to operate substantially as described with reference to and as illustrated by, the accompanying drawings.

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954623 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig.1

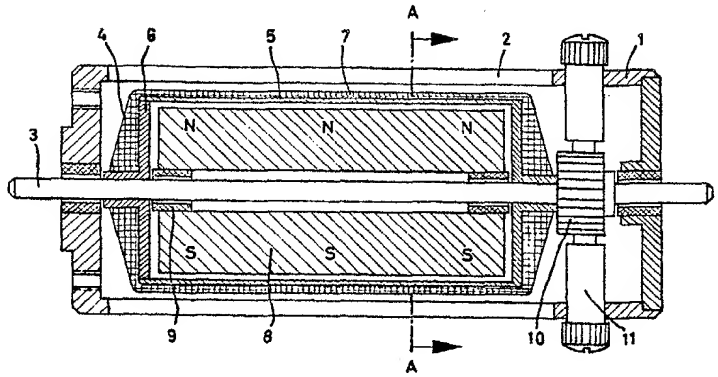

Fig.2